



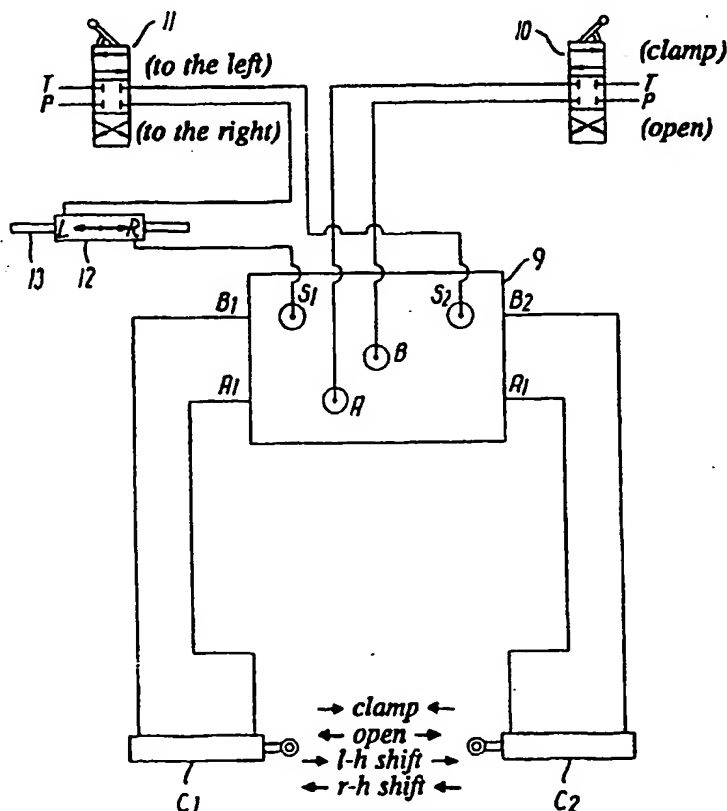
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>5</sup> : <b>B66F 9/22, F15B 15/24</b>		A1	(11) International Publication Number: <b>WO 95/02552</b>
			(43) International Publication Date: 26 January 1995 (26.01.95)
(21) International Application Number: <b>PCT/DK94/00003</b>		(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 3 January 1994 (03.01.94)		Published With international search report.	
(30) Priority Data: 0848/93                      16 July 1993 (16.07.93)                      DK			
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(54) Title: **HYDRAULICALLY CONTROLLED CARRYING AND GRIPPING DEVICE, PREFERABLY FOR USE ON FORK-LIFT TRUCKS**

## (57) Abstract

In a hydraulically controlled carrying and gripping device, of which solely the translatable cylinders (C1, C2) for the fork tines are shown, and in which clamping and opening movements by moving the fork tines towards and away from each other respectively may be performed under the control of a clamping valve (10), and in which the fork tines can be moved in the same direction to the right or left under the control of a lateral-shift valve (11), the main new feature is a volume limiter (12), e.g. in the form of a cylinder with a piston, inserted in the conduits to the lateral-shift valve (11), so as to limit the quantity of liquid flowing through this valve and hence through the translatable cylinders (C1, C2), so that the movements of the latter's piston rods and hence of the fork tines (not shown) are limited. With this arrangement, dangerously unsymmetrical loading of the carrying vehicle, e.g. a fork-lift truck (not shown) is avoided.



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HYDRAULICALLY CONTROLLED CARRYING AND GRIPPING DEVICE, PRE-  
FERABLY FOR USE ON FORK-LIFT TRUCKS.

TECHNICAL FIELD

5 The present invention relates to a hydraulically controlled carrying and gripping device of the kind set forth in the preamble of claim 1.

10 BACKGROUND ART

A device of the kind referred to above is known from US Patent Specification No. 3,166,207.

15 When a device of this kind is placed on a fork-lift truck, it is not only possible to lift or grip and transport e.g. a packing case or box, a bale of straw or a load pallet with goods stacked thereon, situated generally symmetrically about the longitudinal plane of symmetry of the fork-lift  
20 truck, but it is also possible to shift these objects towards one side of the symmetry plane or the other in order to deposit them in locations, in which the outer dimensions of the fork-lift truck would otherwise make it impossible to deposit them.

25 Since a movement away from the plane of symmetry will, however, unavoidably cause a change in the loading of the fork-lift truck, and since its wheels normally will be spring-suspended and/or be provided with pneumatic tires,  
30 the fork-lift truck will for this reason unavoidably heel over to one side or the other.

In recognition of this problem, rules have been issued calling for a limitation of the sideways movement of the carrying and/or gripping means of the fork-lift truck, and the  
35 device disclosed in the above-mentioned US Patent Specifica-

tion No. 3,166,207 operates in such a manner, that it conforms at least in part to these rules.

In the device disclosed in the above-mentioned US Patent Specification No. 3,166,207, the means for limiting the sideways movements of the plane of symmetry of the carrying or gripping means relative to the vehicle are constituted by cam-controlled valves, adapted to interrupt the supply of liquid to the translatable cylinders, when a complicated movement-dividing mechanism mechanically signals the fact that the movement has reached one of the permitted extreme positions. Since said movement-dividing mechanism must necessarily be situated close to or at least mechanically connected to the carrying or gripping means or the translatable cylinders, it is unavoidably exposed to damage, when goods are to be moved, stacked or destacked, and in addition to this, the requisite valves are rather costly and require inspection at regular intervals.

#### DISCLOSURE OF THE INVENTION

On this background, it is the object of the present invention to provide a carrying and gripping device of the kind referred to initially, with which it is possible by the use of simple means to conform to the above-mentioned rules with regard to limiting the sideways movement, and this object is achieved according to the invention by means of the features set forth in the characterizing clause of claim 1. Such a volume limiter, which may e.g. consist of a cylinder with a piston movably supported therein, may be made extremely robust and may be placed in a protected location, where it is not exposed to impact from the objects being handled by means of the carrying and gripping device, this not least being of importance when handling large packing cases and the like.

Advantageous embodiments of the carrying and gripping device according to the invention, the effects of which will be evident from the following detailed portion of the present description, and set forth in claims 2-7.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

In the following detailed portion of the present description, the invention will be explained in more detail with reference to the exemplary embodiment of a hydraulically controlled carrying and gripping device according to the invention shown in the drawings, in which

Fig. 1 shows the device placed on a fork-lift truck,

15

Fig. 2 is a hydraulic circuit diagram showing the connections between those parts of the hydraulic system, with which the invention is concerned, and

Fig. 3 shows the individual components of the switching-valve unit shown in Fig. 2, as well as their mutual connections.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

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The exemplary embodiment of a hydraulically controlled carrying and gripping device according to the invention shown in the drawing comprises in a manner known per se a left-hand fork tine 1 and a right-hand fork tine 2, by means of upper rolling means 3 and 4 and lower rolling means 5 and 6 being laterally translatable supported on a support frame 7, the latter again in a manner not shown in detail being vertically movably supported on the front side of a vehicle in the form of a motorized fork-lift truck 1. For the sake of good order, it should be noted that the expressions "right-hand" and "left-hand" refer to the directions relative

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to the normal direction of movement of the fork-lift truck 8, e.g. with the fork tines 1 and 2 pointing in a forward direction.

5 Each of the two fork tines 1 and 2 is connected to a hydraulic translatory cylinder C1 and C2 respectively, each of which is anchored to one of the two ends of the support frame 7. How the fork tines 1 and 2 can be moved in different ways will now be described in more detail with reference to  
10 Figures 2 and 3.

Thus, in Fig. 2 it will be possible to recognize the two cylinders C1 and C2, these being connected to a clamping control valve 10 and a shifting control valve 11 through a  
15 switching-valve unit 9, the functioning of which is illustrated in more detail in Fig. 3.

By means of the control valves 10 and 11, the cylinders C1 and C2 can be made to operate simultaneously in four different ways, viz.  
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- in a clamping operation, initiated by moving the movable part of the clamping valve 10 downwardly, so that the piston rods of the two cylinders and with them the fork tines 1 and 2 are made to approach each other,

- 25 - in an opening operation, initiated by moving the movable part of the clamping valve 10 upwardly, so that the piston rods of the cylinders and with them the two fork tines 1 and 2 are moved away from each other,

- 30 - a leftward shifting, initiated by moving the movable part of the shifting control valve 11 upwardly, so that the piston rod in the cylinder C1 is moved outwardly and hence moves the left-hand fork tine 1 towards the left relative to the fork-lift truck 8, while at the same time the piston rod in the cylinder C2 is withdrawn and hence moves the  
35 right-hand fork tine 2 likewise towards the left, and

- a rightward shifting, initiated by moving the mo-

vable part of the valve 11 upwardly, so that the piston rod in the cylinder C1 is withdrawn and hence moves the left-hand fork tine 1 towards the right relative to the fork-lift truck 8, while at the same time the piston rod in the cylinder C2 is moved outwardly and hence moves the right-hand fork tine 2 likewise towards the right relative to the fork-lift truck 8.

It is, of course, possible to combine these movements in any manner desired by simultaneous operation of the clamping valve 10 and the shifting valve 11.

Everything having been described up to this point with reference to Figs. 1 and 2 and shown in Fig. 3 belongs the prior art, for which reason a detailed explanation is considered to be superfluous, but for the sake of good order, the parts of the switching-valve unit 9 shown in Fig. 3 will be described in more detail, even though they, as mentioned, belong to the prior art.

Thus, the switching-valve unit 9 comprises a number of connecting points, viz.

- A, that is connected to that connecting point on the clamping valve 10, which in the clamping position of the latter is connected to the tank conduit T of the hydraulic system,

- A1, connected to the piston-rod side of the cylinder C1,

- A2, connected to the piston-rod side of the cylinder C2,

- B, connected to that connecting point on the clamping valve 10, which in the clamping position of the latter is connected to the pump conduit P of the hydraulic system,

- B1, connected to the end of the cylinder C1 facing away from the piston rod,

- B2, connected to the end of the cylinder C2 facing

away from the piston rod,

5       - S1, connected to that connecting point on the shifting valve 11, which in the leftward-movement position of the latter is connected to the pump conduit P of the hydraulic system, and

      - S2, connected to that connecting point on the shifting valve 11, which in said leftward-movement position is connected to the tank conduit T of the hydraulic system.

10       (The device being shown in Fig. 2 as inserted between the connecting point S1 and the shifting valve 11 will be described in more detail below).

15       In addition to the connecting points referred to above, the switching-valve unit 9 comprises three controlled check valves of the kind adapted to function like normal check valves, until pressure is applied through a special control conduit so as to make them open in both directions, viz.

20       - VA, opening as a check valve, when the pressure in the connecting point A is higher than in the connecting points A1 and A2, and opening in both directions, when the pressure in the connecting point B exceeds a predetermined threshold value,

25       - VB1, opening as a check valve, when the pressure in the connecting point B is higher than in the connecting points B1 and S1, and opening in both directions, when the pressure in the connecting point 1 exceeds a predetermined threshold value, and

30       - VB2, opening as a check valve, when the pressure in the connecting point B is higher than in the connecting points B2 and S2, and opening in both directions, when the pressure in the connecting point A exceeds a predetermined threshold value.

35       By looking at Fig. 2 in conjunction with Fig. 3, persons skilled in the art of hydraulic control will easily be able



to see how the movements of the cylinders C1 and C2 and hence of the fork tines 1 and 2 can be controlled by suitable manoeuvring of the clamping valve 10 and/or the shifting valve 11.

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During a lateral-shifting operation, the quantity of liquid passing through the shifting valve 11 and the connecting points S1 and S2 on the switching-valve unit 9 will be in exact proportion to the movement performed by the cylinders C1 and C2 and hence by the fork tines 1 and 2, and conversely, a limiting of this liquid flow will cause a limiting of the movement of the cylinders and hence of the fork tines. On the basis of this interdependence having been recognized, the invention calls for placing a volume limiter in that flow path, in which the flow corresponds to the movement in the same direction of the two cylinders, i.e. a lateral-shifting movement. In the example shown, the volume limiter is constituted by a slave cylinder 12, in which the movements of its piston rod 13 follow the movements of the cylinders C1 and C2 or rather the latter's piston rods, and hence the movements of the fork tines 1 and 2 according to Fig. 1.

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The quantities of liquid on both sides of the piston in the slave cylinder 12 are attuned to the quantities of liquid on both sides of the pistons in the cylinders C1 and C2 in such a manner, that when the two fork tines 1 and 2 are at the same distance from and on either side of the vertical fore-and-aft symmetry plane of the fork-lift truck 8, the piston rod 13 will take up a central position. Correspondingly, the piston rod 13 will be in a position on one side of the central position or the other, as soon as the two fork tines 1 and 2 do not lie symmetrically relative to said plane of symmetry, i.e. that the point mid-way between them has been shifted to one side or the other relative to the plane of symmetry of the fork-lift truck 8.

If the lateral shifting movement of the two fork tines 1 and 2 continues, the movement in the quantity of liquid corresponding thereto will cause the piston rod 13 to be moved to one of its two extreme positions, and since its piston fits in a liquid-tight manner in the cylinder 12, any further flow of liquid will be prevented, and it will no longer be possible to move the fork tines 1 and 2 in the direction concerned. A movement in the opposite direction is, however, possible, until the piston rod 13 reaches its opposite extreme position, in which the flow of liquid is again blocked, thus preventing further movement of the fork tines 1 and 2. At this point, it should be noted that this blockage solely prevents the movements performed by the fork tines 1 and 2 in the same direction under the control of the shifting control valve 11, but not the clamping or opening movements performed under the control of the clamping valve 10.

In Fig. 2, the slave cylinder 12 is shown in the form of a cylinder with a through-going piston rod 13. When constructed in this manner, the slave cylinder 12 may be placed in a position, in which it can be seen by the driver of the fork-lift truck 8, so that the driver can see how far the fork tines 1 and 2 are away from the position of symmetry, such as by observing the position of the piston rod 13 relative to the slave cylinder or - preferably - relative to a scale. It is, however, also possible to construct the slave cylinder 12 or a corresponding volume limiter in the form of a remote-signalling unit, that can be placed in the location being most advantageous with regard to the placing of conduits, being adapted to send signals to e.g. a pointer instrument or a display screen placed in or near the instrument panel of the fork-lift truck 8. Alternatively or additionally, the device can comprise signalling lamps, e.g. red signalling lamps adapted to light up, when the fork tines 1 and 2 approach their extreme positions, and a green lamp

adapted to light up, when the fork tines are in their position of symmetry. Instead of or in addition to these lamps, the equipment may also comprise audible alarm means, especially to give an alarm immediately before and in the extreme positions. Further, the slave cylinder 12 or a corresponding volume limiter may be equipped with adjustable stop means for limiting the movements of the piston rod 13 or a corresponding member, making it possible to adjust the extreme positions, e.g. when adapting the equipment for use with different vehicles.

The adjustable stop means may be adapted to be influenced by the pressure in the lifting cylinder 14 of the fork-lift truck 8, this pressure being an expression of the weight of the goods resting on the fork tines 1 and 2, so that the extreme positions for the lateral shifting movements of the fork tines are moved inwardly, when the goods concerned are heavy, and vice versa.

LIST OF PARTS

	A	Connecting point
	A1	Connecting point
5	A2	Connecting point
	B	Connecting point
	B1	Connecting point
	B2	Connecting point
	C1	Hydraulic translatable cylinder
10	C2	Hydraulic translatable cylinder
	P	Pump conduit
	S1	Connecting point
	S2	Connecting point
	T	Tank conduit
15	VA	Controlled check valve
	VB1	Controlled check valve
	VB2	Controlled check valve
	1	Left-hand fork tine
	2	Right-hand fork tine
20	3	Upper rolling means
	4	Upper rolling means
	5	Lower rolling means
	6	Lower rolling means
	7	Support frame
25	8	Fork-lift truck
	9	Switching-valve unit
	10	Clamping (control) valve
	11	Shifting (control) valve
	12	Slave cylinder
30	13	Piston rod
	14	Lifting cylinder

CLAIMS.

1. Hydraulically controlled carrying and gripping device of the kind comprising

- 5 a) a support frame (7) adapted to be secured movably upwardly and downwardly in a lifting and transport vehicle, e.g. a fork-lift truck (8),
- b) two movable carriages (3,4,5,6) generally horizontally movably supported on the support frame (7) and each carrying or adapted to carry a
- 10 carrying and/or gripping member (1,2),
- c) at least two hydraulic translatory cylinders (C1, C2) placed on the support frame (7) and connecting the movable carriages (3,4,5,6) with
- 15 the support frame (7),
- d) a manually operable gripping-control valve (10) for controlling the movements of the movable carriages (3,4,5,6) in mutually opposite directions,
- 20 e) a manually operable lateral-shift control valve (11) for controlling the movements of the carriages (3,4,5,6) in the same direction,
- f) an automatically operating switching valve (9),
- 25 by operation of the gripping-control valve (10) connecting the hydraulic conduits to the translatory cylinders (C1, C2) in such a manner, that the latter move in mutually opposite directions, and by operation of the lateral-shift control
- 30 valve (11) connects said hydraulic conduits in such a manner, that the translatory cylinders (C1, C2) move in the same direction,
- g) means (12) for limiting the movements of the
- 35 vertical fore-and-aft plane of symmetry of the carriages (3,4,5,6) relative to the vertical fore-and-aft plane of symmetry of the support frame (7),

characterized in that said movement-limiting means consists of a volume limiter (12) inserted in the hydraulic connection between the lateral-shifting control valve (11) and the switching valve (9), said volume limiter (12) consisting of a chamber divided into two parts by means of a tight-fitting separating wall movable between two extreme positions so as to permit only a predetermined quantity of liquid to flow between the lateral-shift control valve (11) and the switching valve (9).

2. Device according to claim 1, characterized in that the chamber is constituted by a cylinder (12), and the separating wall by a piston movable therein in a liquid-tight manner.

3. Device according to claim 1 or 2, characterized in that the extreme positions of the separating wall are adjustable.

4. Device according to any one or any of the claims 1-3, characterized in that the separating wall is connected to means for producing information about the size of the proportion of the predetermined quantity of liquid having passed through it.

5. Device according to any one or any of the claims 1-4, characterized in that the separating wall is connected to means to deliver or trigger a preferably audible alarm signal, when the quantity of liquid having passed through approaches said predetermined quantity of liquid.

6. Device according to any one or any of the claims 1-5, characterized in that the separating wall is connected to means for producing a signal differing from other signals having been produced, when the separating wall is in its central position.

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7. Device according to any one or any of the claims 3-6, characterized in that the extreme positions on the separating wall are adapted to be adjusted depending on the weight of the goods resting on the support frame (7), e.g. as expressed by the pressure in the lifting cylinder (14) of the fork-lift truck (8).

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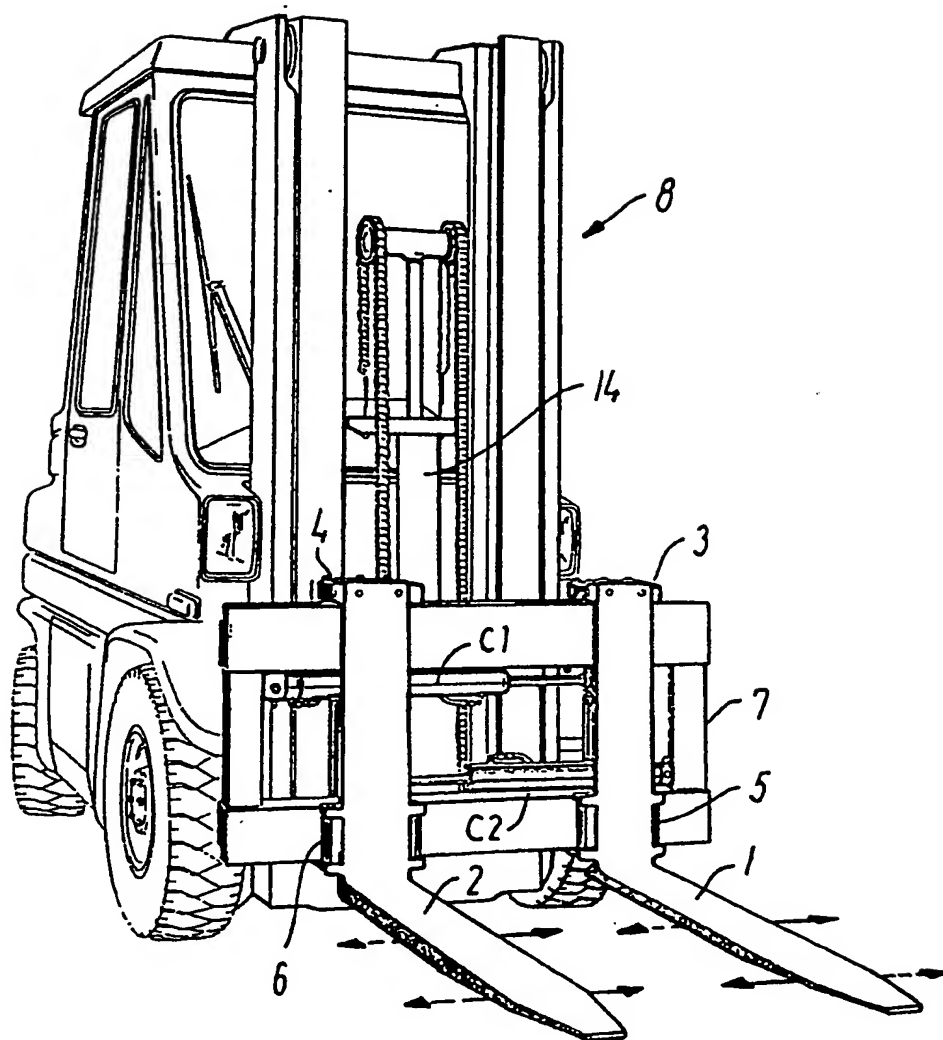


FIG. 1



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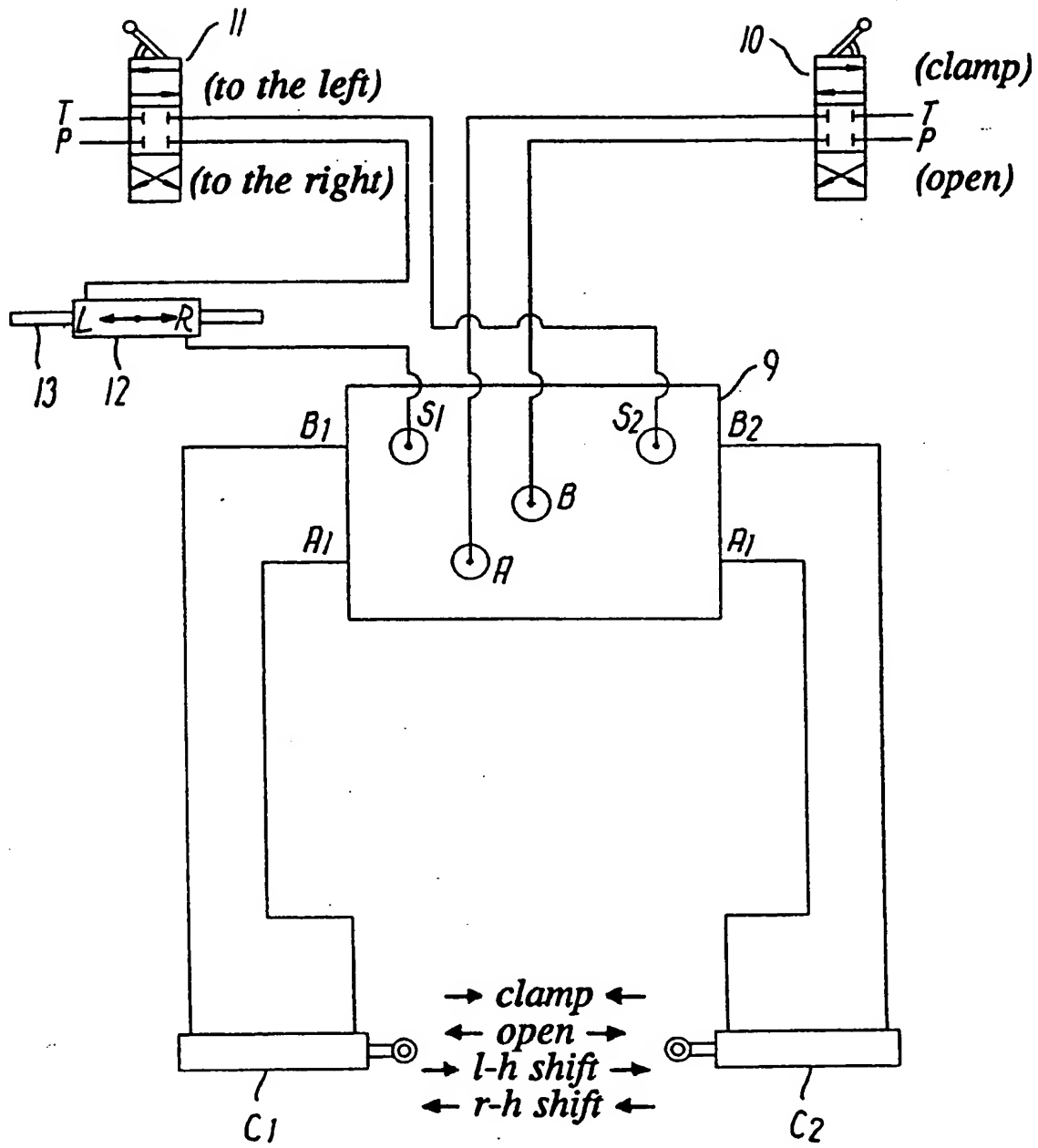


FIG. 2

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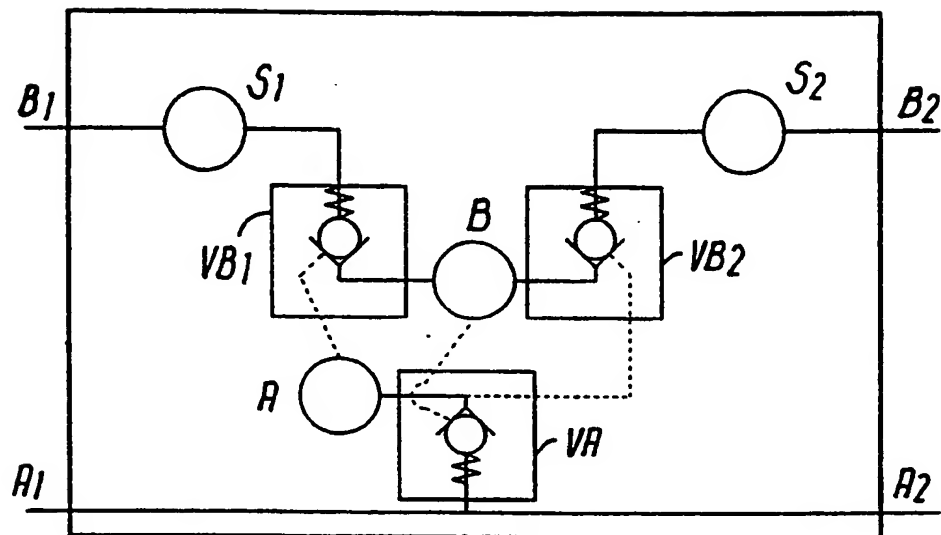


FIG.3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/DK 94/00003

## A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B66F 9/22, F15B 15/24

According to International Patent Classification (IPC) or to both national classification and IPC

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DIALOG: WPI, CLAIMS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE, A1, 2810893 (SAHM, ERWIN WILLI), 27 Sept 1979 (27.09.79), page 4, line 1 - page 5, line 2; page 6, line 22 - page 10, line 25, figure 1	1-4
Y	--	5-7
Y	US, A, 3166207 (G.F. QUAYLE), 19 January 1965 (19.01.65), column 9, line 42 - line 67, figure 13	5,6
A	page 1, line 20 - page 2, line 11; page 3, line 13 - line 18, column 3, line 41 - column 4, line 10, column 5, line 32 - column 6, line 2, figures 1,2,10-10B	1

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

11 April 1994

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO, A1, 8102001 (TOWMOTOR CORPORATION), 23 July 1981 (23.07.81), page 6, line 6 - line 10; page 15, line 13 - page 17, line 4, figure 7	7
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A	--	
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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

26/02/94

International application No.  
PCT/DK 94/00003

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DE-A1-	2810893	27/09/79	NONE		
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